



Food, fun, and fitness internet program for girls: Pilot evaluation of an e-Health youth obesity prevention program examining predictors of obesity

Debbe Thompson^{a,*}, Tom Baranowski^a, Karen Cullen^a, Kathy Watson^a, Yan Liu^a, Ashanti Canada^{a,1}, Riddhi Bhatt^a, Issa Zakeri^b

^a USDA/ARS Children's Nutrition Research Center, Baylor College of Medicine, Department of Pediatrics, Houston, TX, USA

^b Department of Biostatistics and Epidemiology Drexel University 1505 Race Street, MS 1033 Bellet Building, 6th Floor Philadelphia, PA 19102, USA

ARTICLE INFO

Article history:

Available online 30 July 2008

Keywords:

African American
Female
Children
Behavioral research
Diet
Physical activity
Internet
Fruit
Vegetables
Self-efficacy

ABSTRACT

Objective. This pilot study tested whether an Internet-based intervention could achieve change in fruit, juice, and vegetable consumption, physical activity, and self-efficacy in youth at-risk of obesity.

Method. Participants were 80 8-to-10-year-old African American girls at-risk of obesity, with a home computer, Internet access, and an e-mail address. A two-group design was followed. Groups differed only on incentive schedule (immediate, delayed). The 8-week home-based program, conducted entirely over the Internet, promoted fruit, juice, vegetables, and water intake and physical activity. Pre-post measures were collected through self-report via the program website. The study was conducted in the greater Houston, TX, area September through November, 2004.

Results. Statistically significant pre-to-post differences were observed in fruit, juice, and vegetable consumption ($p=.002$), physical activity—yesterday ($p<.001$), physical activity—usually ($p=.001$), and fruit, juice, and vegetable self-efficacy ($p=.003$).

Conclusion. Internet-based obesity prevention programs may be an effective channel for promoting healthy diet and physical activity behaviors to youth at-risk of obesity. Additional research is needed to more fully examine their effectiveness at promoting and maintaining diet and physical activity change.

Published by Elsevier Inc.

Introduction

Approximately 18.8% of 6–11-year-olds have a body mass index ≥ 95 th percentile, with non-Hispanic Black girls more likely to be obese (26.5%) than other girls (Ogden et al., 2006). Obesity results from a long-term energy imbalance (Goran and Treuth, 2001), where energy consumption exceeds expenditure. African American girls have low levels of fruit, 100%-juice, and vegetable (FJV) (typically low-energy dense foods) consumption and physical activity (PA) (Klesges et al., 2008). Together, this places them at increased risk of obesity.

In a recent survey with 8–18-year-olds (Rideout et al., 2005), average daily computer use for non-school related activities was 1:02 h. Sixty-one percent of African American youth and 66% of youth in communities with a median income of $< \$35,000$ reported having home Internet access. Emerging evidence suggests e-Health interventions can change youth diet and PA (Baranowski et al., 2003a; Jago

et al., 2006). Thus, well-designed web-based programs have the potential to reach large numbers of at-risk youth. This manuscript presents behavioral and psychosocial outcomes of an 8-week Internet-based pilot study promoting increased FJV consumption and PA to young girls.

Methods

Participants

Eighty participants were recruited and enrolled. Inclusionary criteria were 8-to-10-year-old African American girls with a body mass index of ≥ 50 th percentile, with a home computer, Internet access, and an e-mail address. Recruitment included both broadcast and non-broadcast methods (Thompson et al., 2006).

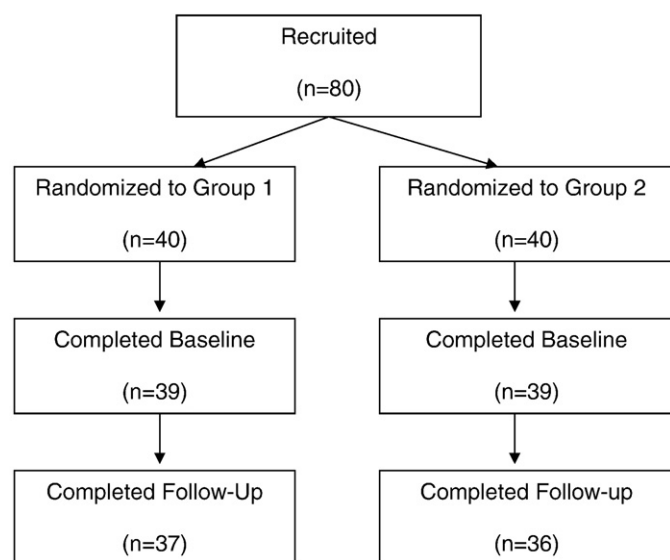
Design

This pilot outcome evaluation is a secondary analysis of a trial assessing the effect of incentive schedule on log-on rates in an Internet-based intervention (Thompson et al., 2007b). The main study followed a randomized, two-group design, with baseline and immediate post-assessment. Groups varied on incentive schedule only (immediate, delayed). This paper reports on the pre-versus-post

* Corresponding author.

E-mail addresses: dit@bcm.tmc.edu (D. Thompson), tbaranow@bcm.tmc.edu (T. Baranowski), kcullen@bcm.tmc.edu (K. Cullen), kwatson@bcm.tmc.edu (K. Watson), yliu3@bcm.tmc.edu (Y. Liu), rbhatt@bcm.tmc.edu (R. Bhatt), ifz23@drexel.edu (I. Zakeri).

¹ Was affiliated with the USDA/ARS Children's Nutrition Research Center when the study was conducted.



This study was conducted September–November, 2004 in the greater Houston, TX area with 8–10 year old African American girls.

Fig. 1. Participant flow chart. This figure provides the flow of participants through the study, as recommended by the CONSORT statement.

behavioral and psychosocial outcomes. The Institutional Review Board at Baylor College of Medicine in Houston, TX, approved the protocol. Written parental consent and child assent were obtained.

Intervention

The 8-week Internet intervention emphasized FJV, water, and PA. The treatment website from a previous study with African American girls (Baranowski et al., 2003b) was adapted to a stand-alone Internet program by adding an introduction and a club member manual.

Social Cognitive Theory (Bandura, 1986) guided the content, while Elaboration Likelihood Model (Petty and Cacioppo, 1986) guided character development, storyline, and design framework (Thompson et al., 2007a). Participants' weekly goals were to increase FJV and water consumption and lifestyle PA. Weekly programming included role modeling comics, problem solving, and goal setting/review. Participants received a weekly incentive worth \$5 for completing all activities. Incentives were awarded on an immediate (within 2 business days) or delayed (end-of-program) schedule. All data collection occurred on the program website.

Measures

FJV consumption

FJV consumption was assessed using a 7-item food frequency questionnaire (Thompson et al., 2000), previously used with children (Engels et al., 2005). Because of known limitations with young children, (Baxter et al., 1997; Cullen et al., 1999), it was modified to recall consumption over the last week. French fries were excluded from analysis. Total daily consumption was determined by summing servings and dividing by 7.

PA recall

PA (yesterday; usually) was assessed with the GEMS Activity Questionnaire. The instrument had adequate reliability (yesterday $r=0.70$, $p<0.0001$; usually $r=0.79$, $p<0.0001$) and validity (yesterday $r=0.27$, $p<0.05$; usually $r=0.29$, $p<0.05$) among 9-year-old African American girls (Treuth et al., 2003). Response scales were PA-yesterday: none=0; <15 min=1, ≥ 15 =2; PA-usually: none=0, a little=1;

a lot=2). Answers were weighted by multiplying each activity response with the corresponding child-appropriate MET value. MET-weighted responses were summed and subsequently divided by total METS.

FJV self-efficacy

FJV self-efficacy was measured with a modified version of a questionnaire that exhibited internal consistency (.72–.87) and two-week test–retest reliability (.52–.67) with youth (Domel et al., 1996). Response options (“do not agree=0”, “slightly agree=1”, “strongly agree=2”) were summed.

PA self-efficacy

PA self-efficacy was measured using a questionnaire exhibiting internal consistency ranging from 0.54 to 0.71 and test–retest reliability ranging from 0.61 to 0.82 (Saunders et al., 1997). Response options (“no=0”, “not sure=1”, “yes=2”) were summed.

Statistical analysis

Repeated measures analysis of variance was used to detect differences in FJV and PA behavior and self-efficacy, separately, between incentive groups (immediate, delayed), time (pre, post), and group-by-time.

Results

Participants

All participants met inclusionary criteria. Two never logged on for baseline assessment. Of the remaining 78 girls, two from Group-1 and three from Group-2 did not participate in post-assessment, leaving 73 (94%) girls (Fig. 1). Analyses were conducted on the remaining 73 girls. There were no significant differences in baseline measures, group, or recruitment source between participants who provided complete and

Table 1

Number of subjects (n), mean (M), standard deviation (SD), and total both groups for behavior and self-efficacy, stratified by incentive return schedules

	Group1		Group2		Total		Multivariate effect size ^a		
	N	M (SD)	N	M (SD)	n	M (SD)	Time (T)	Group (G)	T×G
Physical activity (yesterday) ^b									
Pre	37	2.74 (1.36)	36	2.50 (1.36)	73	2.62 (1.36)	0.32	0.03	0.01
Post	37	4.38 (2.07)	36	3.72 (1.51)	73	4.05 (1.83)			
Physical activity (usually) ^c									
Pre	37	3.98 (1.72)	36	3.49 (1.78)	73	3.74 (1.75)			
Post	37	4.85 (2.19)	36	4.17 (1.69)	73	4.51 (1.98)	0.14	0.03	0.00
Fruit/juice/vegetable (behavior) ^d									
Pre	35	2.36 (1.40)	36	3.06 (1.62)	71	2.71 (1.54)	0.13	0.02	0.02
Post	35	3.75 (2.70)	36	3.69 (2.16)	71	3.72 (2.42)			
Physical activity (self-efficacy)									
Pre	36	29.36 (4.58)	36	28.89 (3.79)	72	29.13 (4.18)	0.01	0.00	0.00
Post	36	28.78 (4.67)	36	28.58 (5.75)	72	28.68 (5.21)			
Fruit/juice/vegetable (self-efficacy) ^e									
Pre	35	51.31 (11.96)	36	48.03 (10.53)	71	49.67 (11.29)	0.12	0.03	0.00
Post	35	56.17 (10.37)	36	53.36 (14.19)	71	54.77 (12.44)			

This study was conducted September – November, 2004 in the greater Houston, TX area with 8–10-year-old African American girls. Note: Although 73 girls completed baseline and follow-up, differences in total sample size across instruments was due to the 1–2 girls who had some missing item responses. This table provides the results of the data analysis reporting changes in behavioral and psychosocial factors.

^a Multivariate effect sizes: small (0.02), small to medium (0.10), medium (0.15), medium to large (0.25), large (0.35).

^b Significant difference over time $F(1,71)=33.71$, $p<0.001$.

^c Significant difference over time $F(1,71)=11.61$, $p=0.001$.

^d Significant difference over time $F(1,69)=9.99$, $p=0.002$.

^e Significant difference over time $F(1,69)=9.30$, $p=0.003$.

incomplete data. Weekly log-on rate averaged 74.5%, and attrition was <10% (Thompson et al., 2007b).

Behavior

FJV consumption

Regardless of group, statistically significant ($p=.002$) pre-post improvement was observed in self-reported FJV consumption (Table 1). At baseline assessment, girls reported an average of 2.71 (± 1.54) servings and at post-assessment, an average of 3.72 (± 2.42) servings (an increase of 1.01 servings, a small-to-medium effect size of 0.13). The group-by-time interaction was nonsignificant.

PA

For “PA-yesterday”, regardless of group assignment, girls had an average of 2.62 baseline PA points (± 1.36) and at post-assessment, an average point total of 4.05 (± 1.83) ($p<.001$) (an increase of 1.43 points, a medium-to-large effect size of 0.32) (Table 1). “PA-usually” also increased, from 3.74 points at baseline (± 1.75) to 4.51 points at post-assessment ($+1.98$) ($p=.001$) (an increase of 0.77 points, a small-to-medium effect size of 0.14). The group-by-time interaction was nonsignificant.

Self-efficacy

A statistically significant increase was observed in FJV self-efficacy ($p=.003$) (an increase of 5.1 points, a small-to-medium effect size of 0.12). The group-by-time interaction was nonsignificant (Table 1).

Change in PA self-efficacy was not significant and decreased between baseline and post-assessment. Group, time, and group-by-time differences in PA self-efficacy were nonsignificant.

Discussion

Pilot testing of the theory-based Food, Fun, and Fitness Internet Program for Girls indicated significant changes in FJV and PA in an at-risk group of young girls, despite the pilot nature of the sample size. This is encouraging given the popularity and availability of the Internet among youth (Rideout et al., 2005) and the need to promote both healthy diet and PA to achieve energy balance and prevent obesity (Goran and Treuth, 2001). This is one of the first studies with an at-risk group of youth to demonstrate that a theory-based obesity prevention program delivered completely over the Internet could change both diet and PA. Since there was no control group, the results should be interpreted with caution. Attrition rates were low and log-on rates were reasonably high, suggesting that an acceptable dose was achieved. This increases confidence in the potential of the program to achieve desired changes.

The current study achieved greater change in FJV and PA than a previous study using the Internet program (Baranowski et al., 2003b). Two differences may explain this: a) differences in log-on rates between the two studies suggest a substantially greater program dose in the current study and b) the current study used an Internet-only approach while the previous study utilized a mixed-intervention approach (summer day camp plus Internet), which may have attracted families more interested in a low-cost summer day camp than the Internet program. Differences observed between the camp attendance (91.5%) and log-on rates to the Internet program (48%) in the previous study support this hypothesis (Baranowski et al., 2003b).

FJV consumption

FJV consumption increased one serving a day. This is comparable to that achieved by Squire's Quest!, a computer-based game promoting increased FJV consumption to 4th graders (Baranowski et al., 2003a). Both multi-component interventions were based on theory and

emphasized analogous skills (i.e., goal setting, problem solving, self monitoring) which may partially explain the similarity in results.

PA

Significant increases in lifestyle PA were observed. Other studies have found Internet-based interventions may not be effective for enhancing PA (Vandelandotte et al., 2007). The current study demonstrates it is possible, but this needs to be confirmed with a larger sample.

Self-efficacy

A statistically significant increase was observed in FJV, but not PA, self-efficacy. Future research needs to test alternative methods for enhancing PA self-efficacy in an Internet-based environment.

Study limitations and strengths

Strengths of this study include a delivery channel that minimized differences in delivery, a low attrition rate, and reasonably high log-on rates (i.e., program dose). Limitations of this pilot study include the use of self-reported measures with the possibility of socially desirable responses, the small sample, the short duration, the lack of a control group, and the requirement to have a home computer with Internet access, which likely excluded at-risk girls. Further, joining of sports groups, family vacations, holidays, chance, or other events may have influenced FJV and PA behavior during the intervention.

Conclusions

Internet-based e-Health programs promoting healthy eating and PA behaviors to 8–10-year-old African American girls appear feasible and may promote healthy diet and PA behaviors. Future research needs to conduct a full-scale randomized control trial to more fully examine the impact on diet and PA and to evaluate maintenance effects.

Conflict of interest statement

The authors report no conflict of interests.

Acknowledgments

This research was largely funded by a grant to the first author from the Robert Wood Johnson e-Health Technologies Initiative (grant number 49128). The Internet program was originally developed as part of the multi-site Girls health Enrichment Multi-site Study (GEMS), funded by the National Heart, Lung, and Blood Institute of the National Institutes of Health (grant number U01 HL65160). This work is also a publication of the United States Department of Agriculture (USDA/ARS) Children's Nutrition Research Center, Department of Pediatrics, Baylor College of Medicine, Houston, Texas, and had been funded in part with federal funds from the USDA/ARS under Cooperative Agreement No. 58-6250-6001. The contents of this publication do not necessarily reflect the views or policies of the USDA, nor does mention of trade names, commercial products, or organizations imply endorsement from the U.S. government.

References

- Bandura, A., 1986. Social Foundations of Thought and Action: A Social Cognitive Theory. Prentice Hall, Englewood Cliffs, NJ.
- Baranowski, T., Baranowski, J., Cullen, K.W., et al., 2003a. "Squire's Quest!" dietary outcome evaluation of a multimedia game. *Am. J. Prev. Med.* 24, 52–61.
- Baranowski, T., Baranowski, J., Cullen, K.W., et al., 2003b. The Fun, Food and Fitness Project (FFFP): The Baylor GEMS pilot study. *Ethn. Dis.* 13 (suppl 1), S1–S39.
- Baxter, S.D., Thompson, W.O., Davis, H.C., et al., 1997. Impact of gender, ethnicity, meal component, and time interval between eating and reporting on accuracy of fourth-graders' self-reports of school lunch. *J. Am. Diet. Assoc.* 97 (11), 1293–1298.

- Cullen, K., Baranowski, T., Baranowski, J., et al., 1999. Pilot study of the validity and reliability of brief fruit, juice and vegetable screeners among inner city African-American boys and 17 to 20 year old adults. *J. Am. Coll. Nutr.* 18 (5), 442–450.
- Domel, S., Thompson, W., Davis, H., et al., 1996. Psychosocial predictors of fruit and vegetable consumption among elementary school children. *Health Educ. Res.: Theory. Prac.* 11, 299–308.
- Engels, H.J., Gretebeck, R.J., Gretebeck, K.A., et al., 2005. Promoting healthful diets and exercise: efficacy of a 12-week after-school program in urban African Americans. *J. Am. Diet. Assoc.* 105 (3), 455–459.
- Goran, M.I., Treuth, M.S., 2001. Energy expenditure, physical activity, and obesity in children. *Pediatr. Clin. North Am.* 48 (4), 931–953.
- Jago, R., Baranowski, T., Baranowski, J., et al., 2006. Fit for life boy scout badge: outcome evaluation of a troop and internet intervention. *Prev. Med.* 42, 181–187.
- Klesges, R.C., Obarzanek, E., Klesges, L.M., et al., 2008. Memphis Girls health Enrichment Multi-site Studies (GEMS) Phase 2: design and baseline. *Contemp. Clin. Trials* 29 (1), 42–55.
- Ogden, C.L., Carroll, M.D., Curtin, L.R., et al., 2006. Prevalence of overweight and obesity in the United States, 1999–2004. *JAMA* 295 (13), 1549–1555.
- Petty, R., Cacioppo, J., 1986. *Communication and Persuasion: Central and Peripheral Routes to Attitude Change*. Springer-Verlag, New York.
- Rideout V., Roberts D., Foehr U., 2005. Executive Summary: Generation M: Media in the Lives of 8–18 Year-olds; available: <http://www.kff.org/entmedia/upload/Executive-Summary-Generation-M-Media-in-the-Lives-of-8-18-Year-olds.pdf>. Menlo Park, CA, The Henry J. Kaiser Family Foundation.
- Saunders, R., Pate, R., Felton, G., et al., 1997. Development of questionnaires to measure psychosocial influences on children's physical activity. *Prev. Med.* 26, 241–247.
- Thompson, F.E., Kipnis, V., Subar, A.F., et al., 2000. Evaluation of 2 brief instruments and a food-frequency questionnaire to estimate daily number of servings of fruit and vegetables. *Am. J. Clin. Nutr.* 71 (6), 1503–1510.
- Thompson, D., Canada, A., Bhatt, R., et al., 2006. e-Health recruitment challenges. *Eval. Program Plann.* 29, 433–440.
- Thompson D., Baranowski J., Cullen K., et al., 2007a. Development of a theory-based Internet program promoting maintenance of diet and physical activity change to 8 year old African American girls. *Computers & Education*, 48(3), 446–459 doi:10.1016/j.compedu.2005.02.005.
- Thompson D., Baranowski T., Cullen K., et al., 2007b. Food, Fun, & Fitness Internet Program: Incentives, Recruitment Source, and Log-on Rate. *Health Education Research*. doi:10.1093/her/cym020.
- Treuth, M., Sherwood, N., Butte, N., et al., 2003. Validity and reliability of activity measures in African-American girls for GEMS. *Med. Sci. Sports Exerc.* 35 (3), 532–539.
- Vandelandotte, C., Spathonis, K.M., Eakin, E.G., et al., 2007. Website-delivered physical activity interventions a review of the literature. *Am. J. Prev. Med.* 33 (1), 54–64.